



U.S. Department of Energy
Energy Efficiency and Renewable Energy

DOE Solar Energy Technologies Program Inverter R&D

Dan Ton

The DOE Workshop on a
Systems Driven Approach
To Inverter Research & Development

Maritime Institute, Baltimore, MD
April 23-24, 2003



PV Inverters

- **Past –Reliability/cost Issues:**
 - Different Program Focus
 - Low Volume, Customized Designs, Discrete Components
 - Inadequate Quality Control
 - Implementation Barriers
- **Present-Quality/cost Improving:**
 - New System Reliability Emphasis
 - Crosscutting Other DER Technologies
 - Quality Improving - QA Programs, HALT testing
 - Standards Reducing Barriers
- **Future Opportunities:**
 - Modular, Multi-purpose, Plug-and-play
 - All Digital Processing
 - Crosscutting Many Technologies > Economies of Scale



Recent Solar Program Inverter Activities

- **Interconnection Standards (UL1741, IEEE 929, IEEE 1547)**
- **Laboratory Testing at Sandia**
 - **Benchmark Commercial Products**
 - **Development Tests for Manufacturers**
 - **Special User-requested Tests (Utilities)**
- **Inverter Certification**
 - **Test Protocol Nearly Complete**
 - **Basis for Collaborative Long-term Testing**
- **Industry Contracts**
 - **HALT Testing (Extended MTFF by Factor of 3)**
 - **Manufacturing Quality Programs and Audits**
- **High Reliability Inverter Development Program**



High Reliability Inverter Program Objectives

- **Greater Than 10-year MTFF (2004 goal)**
- **Lower Inverter Costs**
- **Modular Design for Multiple Technologies**
(PV, Storage, Fuel Cell, DER)
- **Flexible Design for Multiple Applications**
(Grid-tied, Stand-alone, Hybrid, UPS)
- **Scalable - < 10 kW Initial Size**



High Reliability Inverter Program Team

- **DOE:**
Richard King (PV), Pat Hoffman (DER), Imre Gyuk (ESS)
- **Sandia:**
Ward Bower, Sig Gonzalez, Jerry Ginn, John Stevens
Mark Ralph, Michael Quintana, [Russ Bonn]
- **Industry:**
 - GE
 - SatCon
 - Xantrex



High Reliability Program Status

- **All Phases Cost-shared by Industry (50% Minimum)**
- **Phase I - Feasibility Study**
 - **Contract Awards 8/2002**
 - **GE, SatCon, Xantrex**
 - **Studies completed 12/2002**
- **Phase II - Finalize design**
 - **Contract Awards May 2003**
- **Phase III – Final Prototype Hardware**
 - **Contract Awards August 2004 Estimated**



High Reliability Inverter Program Budget

- **FY 02: \$550K Total**
 - **PV-\$300K**
 - **DER- \$150K**
 - **Storage - \$100K**
- **FY 03: \$2 M**
- **FY 04: \$1.5M**
- **FY 05: \$1.5M**



Future Inverter R&D

- **Adjust High Reliability Inverter Program**
 - Workshop Consensus
 - Systems Driven Approach
- **Chart Future Inverter R&D**
 - Inputs: Workshop Outcome, Multi-Year Program Plan
 - Expected Outcomes:
 - 5-year Inverter R&D Plan
 - Modeling, Manufacturing, Thermal Management,...
 - Emphasis on Multiple Applications
- **Involve SBIR**
 - “Plug & Play” Modular Inverter With Automotive & Other Technology Ties
 - AC PV Building Block- The Integrated Inverter Design Options



Solar Program/EERE and the Rest of DOE

- **Current Collaboration**
 - PV, DER and Storage in the High Reliability Inverter Program
- **Other Possible Collaborations:**
 - Office of Transmission and Distribution Reliability
 - FreedomCar and Vehicle Technologies Program
 - Cross Cutting in Monolithic Building Blocks, Plug & Play
 - Technologies with Established High Volume (UPS, Motor Drives, etc.)
- **Solar Program Looking for Opportunities to Collaborate**
 - Develop a Core/modular Inverter Program
 - Push for an Economies of Scale
 - Consolidate and Focus Resources
 - Avoid “Re-invention of the Wheel”